From: Thomas Pogue [mailto:tpogue@PACIFIC.EDU]
Sent: Monday, November 14, 2011 9:24 AM
To: 'Elizabeth Soderstrom'
Cc: Hastings, Lauren@DeltaCouncil; Jeffrey Michael; Robert Pyke; Mike Conrad
Subject: Delta ESP Indepent Review Panel's Comment No. 4 on Weaknesses
Importance: High

Dear Elizabeth/Lauren,

Please forward this to the review panel for their reference. Below is a description of the attachments and details regarding the ESP's estimated costs of upgrading lowland levees.

Best regards,
Thomas Pogue

Re: Weakness No. 4

The many references to cost estimates in the report are flagged in the attachment (Chpt 5_2011 10 10_re_No4.docx).

The estimated cost of improving levees to the Delta-specific PL 84-99 standard is based on actual costs incurred by the Reclamation districts in recent years. We cite a cost of $1-2 million per mile. As a means of comparison, the DRMS Phase 2 report cites an average cost of $1.6 million per mile for improving existing levees to the Delta-specific PL 84-99 standard. To substantiate our $1-2 million per mile cost estimate, we are attaching three items: a summary of recent costs for several islands (SampleSummaryTable.xlsx) ; a more detailed breakdown for one of these, on Webb Tract (Webb Tract Historical Construction Costs.xlsx); and a drawing that shows the improvements on Webb tract (C4 Details.pdf). Note that this includes provision for items like moving siphons.

However, there are no land acquisition costs because, unlike projects levees, the reclamation districts rarely, if ever, actually own the land under their levees. They may or may not even have formal easements. But because on most islands there are only a limited number of owners, and frequently there is just a single owner, the landowners, in effect, cede the small amounts of land that are necessary for widening levees to themselves as the reclamation district.

In some cases giving up agricultural acreage for borrow pits has been more contentious. For example, McDonald Island, where 90 percent of the costs of the reclamation district is born by PG&E, (who maintain a major natural gas storage facility on and under the island), the farmer/landowners have resisted giving up acreage for borrow pits because they pay only 10 cents on the dollar for the cost of imported fill. But, more generally, the farmer/landowners have been willing to convert a small amount of land to a borrow pit, which then becomes a pond with some wildlife benefits, in exchange for improved flood protection.

In considering further widening of the levees to create "fat" levees, it is critically important to understand that lowland levees have few encroachments as opposed to the project levees along the Sacramento River. Project levees, such as those between Sacramento and Ryde, not only have permanent crops close to the toes of the levees, but also have houses and other structures abutting the levees. Because of both drainage issues and the relatively higher risk of flooding, there are few

permanent crops on the islands protected by lowland levees. While there are bridges and ferry crossings, the occasional duck club, and a number of marinas adjacent to the lowland levees, the additional cost of designing around these is not significant to a program that might cost $1 billion or more. The open nature of most lowland levees can be seen in Figure C-9, which shows the landside berm constructed on McDonald Island, and by using Google Earth.

The base estimate of a cost of $2-3 million per mile for further improving a Delta-specific PL 84-99 levee to a "fat" levee is based on the estimate of $2 million per mile provided by Hultgren-Tillis Engineers (HTE) in their report on seismically repairable levees for Webb Tract for a "fill only" levee improvement. That report was only conceptual in nature but the cost estimates were conservative estimates based on recent actual construction costs for lesser improvements. HTE estimated that the fill required would range from 125,000 to 150,000 cubic yards per mile. That translates to a cost per cubic yard of $13-16 per cubic yard. The actual cost of just the fill has consistently been around $6 per cubic yard for some time so that HTE more than doubled that figure to provide for the need for some additional rip-rap, an all-weather two land road, road and the need to move siphons, pumps and drains, and so on. We applied an additional contingency of 50 percent to obtain the figure of $2-3 million per mile. This figure easily accommodates engineering as well as construction costs when performed at the local level.

We then used a range of 300-600 miles of levees that might need improvement to this higher standard. The 300 mile figure is the better estimate but we doubled that for budgetary purposes. The 300 miles figure is based on the fact that there are 470 miles of non-project lowland levees. When fully improved to the Delta-specific PL 84-99 standard, many of these levees might in fact be seismically robust if they do not contain looser sands and silts. Since this has not been yet been established, we assumed two-thirds of the levees would need improvement. If one assumes that all lowland levees, including the project levees, need improvement to this higher standard, then about 600 miles of levees would be involved. Extension of the cost of $2-3 million per mile for 300-600 miles of levees gives a range of $600 million to $1.8 billion. We rounded those numbers up to an estimate for basic engineering and construction costs of $1-2 billion.

Our suggestion of planning for a possible total program cost of $4 billion does allow for:
(1) improving a greater length of levees;
(2) an even wider crest width at selected locations for the construction of recreational and tourism facilities or the addition of further engineering features such as drains or cut-off walls at critical locations;
(3) less than optimum program management if the state and federal governments are heavily involved; and
(4) ecosystem restoration features, although we believe that is largely a separate issue which should be priced separately.